

**IN THE UNITED STATES DISTRICT COURT  
FOR THE WESTERN DISTRICT OF TEXAS  
SAN ANTONIO DIVISION**

WAVE NEUROSCIENCE, INC., A  
DELAWARE CORPORATION;  
*Plaintiff*

-VS-

BRAIN FREQUENCY LLC, A TEXAS  
LIMITED LIABILITY COMPANY;  
*Defendant*

SA-23-CV-00626-XR

## CLAIM CONSTRUCTION ORDER

On this date, the Court considered the parties’ opening claim construction briefs (ECF Nos. 732, 34), and responses (ECF Nos. 37, 38) and replies (ECF Nos. 40, 41) thereto. In addition, the Court considered the joint claim construction chart (ECF No. 31) and the arguments made by the parties at the *Markman* hearing held on October 30, 2024. After careful consideration, the Court issues the following order construing six disputed claim terms.

## BACKGROUND

This is a patent infringement case. The patents-in-suit are directed to the use of Transcranial Magnetic Stimulation (“TMS”) to improve a variety of brain disorders and cognitive functioning, specifically by targeting certain metrics obtained by an electroencephalogram (“EEG”). According to Plaintiff Wave Neuroscience, Inc. (“Wave”), Defendant Brain Frequency LLC (“Brain”) infringed three patents: (i) U.S. Patent No. 8,926,490 (the “’490 Patent”), (ii) U.S. Patent No. 9,015,057 (“’057 Patent), and (iii) U.S. Patent No. 11,311,741 (“’741 Patent”).<sup>1</sup> ECF No. 5. Brain

<sup>1</sup> Wave's initial complaint asserted infringement claims against Windmill Wellness Ranch LLC, ECF No. 1, but it dropped these in its operative Amended Complaint, ECF No. 5. Wave also claimed infringement of U.S. Patent No. 10,029,111 ("111 Patent"), but the parties represented at the *Markman* hearing that they would be stipulating to the dismissal of these claims. No written stipulation has been filed with the Court to date.

has asserted counterclaims against Wave for a declaratory judgment of non-infringement and invalidity. ECF No. 17.

In May 2024, the parties filed an amended joint claim construction brief. ECF No. 31. The parties agreed on twelve claim terms and identified fourteen in dispute, including seven which Brain asserts are invalid for indefiniteness (as well as lack of enablement and written description). ECF No. 31. On October 30, 2024, after the parties' claim construction arguments were fully briefed (ECF Nos. 32, 34, 37, 38, 40, 41), the Court held a *Markman* hearing on the disputed terms.

The Court declined to find certain claims invalid for indefiniteness at the claim construction stage, deferring the question until summary judgment. *See Uretex Holdings, Inc. v. YD W. Coast Homes, Inc.*, No: 8:15-cv-472-T-36JSS, 2016 WL 3021880, at \*3 (M.D. Fla. May 26, 2016) (“[S]everal well-settled principles tend to discourage rulings on indefiniteness at the *Markman* stage.”) (cleaned up); *Indus. Tech. Rsch. Inst. v. LG Elecs. Inc.*, No. 3:13-CV-2016-GPC-WVG, 2014 WL 6907449, at \*3 (S.D. Cal. Dec. 8, 2014) (deferring determination of indefiniteness to a later stage of the proceedings). The parties represented to the Court that they agreed on another term during the hearing.<sup>2</sup> The Court is therefore left with six claim terms to construe.

## DISCUSSION

### I. Legal Standard

Claim construction is a matter of law. *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 372 (1996). “The purpose of claim construction is to ‘determine the meaning and scope of the patent claims asserted to be infringed.’” *O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360 (Fed. Cir. 2008) (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d

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<sup>2</sup> This term is “second” and “third” intrinsic frequency. To date, the parties have not submitted a stipulation as to the meaning of this term.

967, 976 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370). “When the parties present a fundamental dispute regarding the scope of a claim term, it is the court’s duty to resolve it.” *Id.* at 1362.

Claim terms “are generally given their ordinary and customary meaning.” *Vitronics Corp. v. Conceptoronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). The ordinary and customary meaning of a term “is the meaning that the term would have to a person of ordinary skill in the art in question at the time of invention[.]” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005). “In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent[.]” *Id.* at 1314. “[C]laim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.” *Id.* Indeed, “[w]hile claim construction is a matter for the Court, it need not provide a new definition or rewrite a term, particularly when the Court finds the term’s plain and ordinary meaning is sufficient.” *Alexam, Inc. v. Best Buy Co.*, No. 2:10CV93, 2012 WL 1188406, at \*5 (E.D. Tex. Apr. 9, 2012).

However, “because the meaning of a claim term as understood by persons of skill in the art is often not immediately apparent, . . . the court looks to ‘those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean.’” *Phillips*, 415 F.3d at 1314 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)). “Those sources include ‘the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.’” *Id.*

“To properly construe a claim term, a court first considers the intrinsic evidence, starting with the language of the claims.” *Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1369–70 (Fed. Cir. 2005) (citing *Vitronics*, 90 F.3d at 1582). The entirety of the specification is relevant

to claim construction, including the abstract, summary and preferred embodiment. *See generally* *Lucent Techs., Inc. v. Gateway, Inc.*, 525 F.3d 1200 (Fed. Cir. 2008) (examining the entirety of the specification in performing claim construction). “If the meaning of a claim term is clear from the intrinsic evidence, there is no reason to resort to extrinsic evidence.” *Seabed Geosolutions (US) Inc. v. Magseis FF LLC*, 8 F.4th 1285, 1287 (Fed. Cir. 2021). But where extrinsic evidence is consistent with intrinsic evidence and the extrinsic evidence would help determine the true meaning of the claims, a court may properly turn to that evidence. *Id.*; *Phillips*, 415 F.3d at 1318.

## II. Analysis

### a. Applicable Person of Ordinary Skill in the Art

The parties submit different requirements for persons of ordinary skill in the art (“POSITA”) for the patents-in-suit. They dispute the specific educational background and what type of “training and experience” a POSITA must have. Because each compensates for the other, the Court adopts a combination of both.

As for education, Wave asserts that the POSITA must have a “[b]achelor’s degree in electrical engineering or biomedical engineering, or graduate degree in mental health or neuroscience, with classes directed to electrophysiology and signal processing.”<sup>3</sup> Wave *Markman* Presentation (“Wave Presentation”) at 9. Brain, on the other hand, argues that the POSITA need only have a “graduate degree in mental health, neuroscience, or a related field with substantially similar courses.” ECF No. 34-1 ¶ 16. The difference between these two boils down to whether the POSITA needs to have an engineering background. According to Brain, an engineering

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<sup>3</sup> Wave offered these POSITA qualifications at the *Markman* hearing, which slightly differed slightly from the proposed POSITA by its expert, Dr. Bikson. ECF No. 32-5 ¶ 13. Dr. Bikson’s POSITA did not account for a graduate degree in mental health.

background is not useful for these patents due to their simplicity and non-technical nature, while Wave claims the patents-in-suit are engineering focused.

The Court finds Brain’s argument more persuasive. “In resolving the level of ordinary skill, courts consider the types of and solutions to problems encountered in the art, the speed of innovation, the sophistication of the technology, and the education of workers active in the field.” *See Luminati Networks, Ltd. v. Teso LT, UAB*, No. 2:19-CV-00395-JRG, 2020 WL 7222818, at \*4 (E.D. Tex. Dec. 7, 2020). “The patent’s purpose can also be informative.” *Best Med. Int’l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citation omitted).

Here, the purpose of the patents-in-suit is to provide better TMS treatment for certain brain disorders by using data measured by an EEG. Contemporary TMS treatment dates to the late twentieth century, although the parties disagree on the extent of customization until recently. *See Brain Presentation* at 8–9. In any event, the technology is not so sophisticated that an engineering degree is required. As Brain’s counsel showed at the *Markman* hearing, there are essentially two pieces of technology used in the treatment (the “cap” and the “wand”), neither of which requires specific engineering experience. And the patents themselves describe the “methods, devices, and systems” as an “easy to use therapy for a number of disorders.” ’737 Patent (Abstract); ’490 Patent (same); ’480 Patent (same).

While certain metrics, such as “intrinsic frequency,” “Q-Factor,” “coherence value,” and “EEG Phase” are somewhat technical and used as benchmarks to guide TMS treatment, understanding these terms is not so complex that they would necessarily be lost on someone without an engineering degree. The mathematical calculus for them is also done by a computer, not the POSITAs themselves. Outside of these terms, the claims themselves discuss the treatment at a high level: “(a) adjusting output of a magnetic field, (b) applying said magnetic field close to

the head of a subject; and (c) moving, using the magnetic field, at least one of [these certain metrics towards a target metric.]” ’737 Patent at 79:55–80:10; ’408 Patent at 66:22–50 (same); ’490 Patent at 85:22–86:3 (similar).

Understanding what these terms mean, and how they are used in the patents can also be acquired through “advanced training and experience” in the field of TMS treatment. Indeed, Brain’s founder, Shannon Malish, is a Licensed Clinical Social Worker, who, while having “advanced training and experience,” lacks an engineering degree. ECF No. 30–3. Any deficit in education is offset by the “advanced training and experience.” Requiring that a POSITA have an engineering background or have taken specific classes would be too restrictive.

As for what type of “advanced training and experience” a POSITA needs to have, Wave asserts either (i) “at least three (3) years of research or instruction specifically directed to the use of EEG and TMS technology in treating patients with brain disorders and/or for improving neurocognitive performance,” *or* (ii) “at least three (3) years of experience in a job working with patients having brain disorders using treatment protocols involving EEG and TMS.” Wave Presentation at 9. Brain’s approach is more general: it offers a POSITA that has “3–4 years of work experience, in addition to having advanced training and experience in use of [ ] EEG [*and*] TMS technology.” ECF No. 34–1 ¶ 16; *see* ECF No. 47 at 7 (adopting the conjunctive “and”).

The Court agrees with Wave to an extent. The Court finds that a POSITA could have “advanced training and experience” by either “research or instruction specifically directed to the use of EEG and TMS” or “working with patients,” as both would encounter problems and solutions in the art, would be aware of innovations by practice, and are workers active in the general field, although in different spaces. As each of the patents-in-suit relate to treatment of brain disorders, Wave’s proposed limiting factor as involving brain disorders is appropriate. A strict cut-off of

three years of experience, however, is unnecessary because one's "advanced training and experience" is not so binary.

Accordingly, the Court concludes that the POSITA is someone having: (i) a graduate degree in mental health, neuroscience, or a related field with substantially similar courses *and* (ii) advanced training and experience in the use of EEG and TMS technology relating to treatment of brain disorders, whether through research or instruction, or working with patients.

#### **b. Contested Claim Terms**

The parties ask the Court to construe six claim terms. The parties' proposed constructions for each of the six claim terms all establish a fundamental dispute on the scope of the claim terms. Construction of each disputed claim term is therefore necessary.

##### **i. "intrinsic frequency"**

The term "intrinsic frequency" appears in claim 1 of the '490 Patent, claims 1–2, 12, and 20 of the '408 Patent, and claims 1–2 and 4 of the '737 Patent. Wave requests that the Court construe the term to mean "frequency selected to which treatment is to be applied." ECF No. 31 at 6. Brain asks the Court to construe the term as implied from the patents' specifications: "the frequency ( $f_0$ ) at which peak signal power in the specified band ( $E_{max}$ ) is located." *Id.* Both parties' constructions are consistent with the intrinsic evidence but approach the claim from different levels of specificity.

All the patents-in-suit use a subject's "intrinsic frequency" in two ways: (i) determining the intrinsic frequency of a subject and (ii) influencing an intrinsic frequency of a subject (by shifting it towards a "pre-selected [targeted] intrinsic frequency"). *See* '490 Patent at 1:48, 2:27; '737 Patent at 1:40–41, 2:25–26, '408 Patent at 1:48, 2:28–29 (using "modulating" instead of "influencing"). Both parties agreed during the *Markman* hearing that a subject's "intrinsic

frequency” is an objective fact that is obtained through EEG data, rather than a subjective determination. Wave’s expert, Dr. Bikson, admits this as well: each “subject has their own internal, i.e. intrinsic, frequency which can be measured by an EEG.” ECF No. 32-5 ¶ 61.

Wave and Brain both argue their respective constructions are supported by the intrinsic evidence. The Court agrees. Wave references many specifications in which “intrinsic frequency” is used as the specific biometric marker of the subject to be adjusted during treatment. ECF No. 32 at 18–20. Most of these references do not *define* what “intrinsic frequency” is, or how it is measured, but some do. Brain likewise points to examples in the written descriptions which demonstrate a single meaning of the term. “[T]he specification is ‘the single best guide to the meaning of a disputed term,’” and “‘acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication.’” *Phillips*, 415 F.3d at 1321 (quoting *Vitronics*, 90 F.3d at 1582). “[W]hen a patentee uses a claim term throughout the entire patent specification, in a manner consistent with only a single meaning, he has defined that term ‘by implication.’” *Bell Atlantic Network Servs., Inc. v. Covad Comm’n Grp., Inc.*, 262 F.3d 1257, 1271 (Fed. Cir. 2001) (quoting *Vitronics*, 90 F.3d at 1582). The Court finds the intrinsic evidence determinative.

Patents ’490 and ’737 explain how “intrinsic frequency” is obtained:<sup>4</sup> by collecting EEG data from a subject’s brain and applying a mathematical technique known as a Fast Fourier Transformation to the data to obtain the frequency distribution using the “optimal fit” (a Gaussian fit).<sup>5</sup> ’490 Patent at 1:47–2:12, ’737 Patent at 1:45–2:10. The EEG data reflect brain oscillations, or waves, represented as a function of time (amplitude versus time), and the mathematical technique (the Fast Fourier Transformation) converts it to a function of frequency (amplitude

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<sup>4</sup> The ’408 Patent uses the term “intrinsic frequency” without explaining how it is calculated.

<sup>5</sup> While the patents specify the mathematical formula for a Fast Fourier Transformation and the resulting fitted curve, the actual computation is done by a computer and algorithm, rather than an individual technician.



versus hertz). *See* '490 Patent at 1:47–2:12; '737 Patent at 1:47–2:12. The patents' specifications both define and visually represent where the “intrinsic frequency” is located on the curve, or frequency distribution.

Figure 12 in each of the asserted patents shows a “sample graph of the frequency distribution,” in other words the Fast Fourier Transformation of the initial EEG data (“EEG signal,” *see, e.g.*, '408 Patent at 15:51).

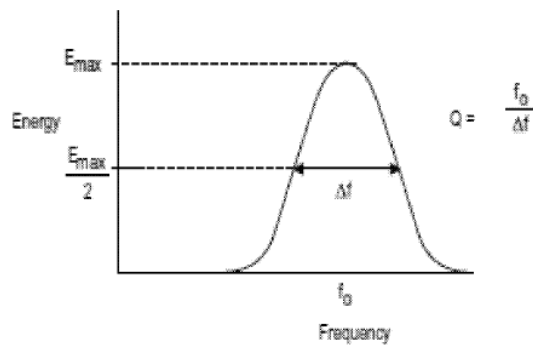


Figure 12

In Figure 12’s “frequency distribution,” the “intrinsic frequency” is explicitly defined as “the frequency ( $f_0$ ) at which peak signal power in the specified band ( $E_{\max}$ ) is located.” '408 Patent at 15:54–55. As Brain correctly points out, this definition is not limited to Figure 12 itself, because the formula applies to “the invention” as a whole. '408 Patent at 15:49; '490 Patent at 22:19–20; '737 Patent at 20:30–31.

Other specifications confirm this interpretation. Figures 36a and 36b in both the '490 Patent and '737 Patent show “sample fitted curves,” '490 Patent at 27:56–57, '737 Patent at 26:37–38, of the “Fast Fourier Transformation curve of EEG data of an example EEG waveform,” wherein the “Fast Fourier Transformation curve ha[s] an intrinsic frequency [at the peak].”

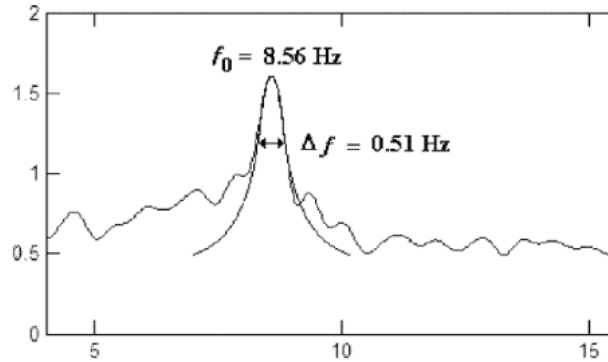


Figure 36a

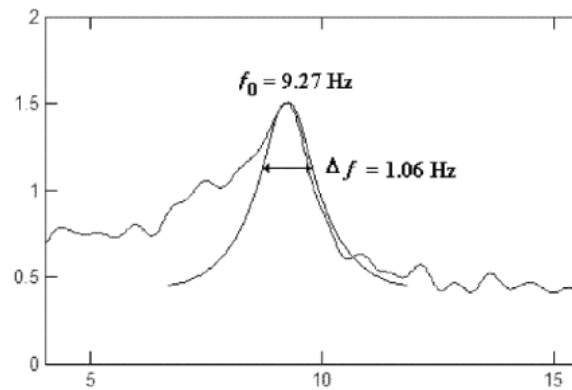


Figure 36b

These figures representing the Fast Fourier Transformation curves of the EEG data demonstrate that a subject's "intrinsic frequency" is selected from the Fast Fourier Transformation curve and is used in the treatment. The "intrinsic frequency" ( $f_0$ ) is the "peak" in the specified band. *See also* '408 Patent at 15:9–11 (noting in Figure 5 that the "[t]he vertical line drawn through the peaks is . . . the subject's intrinsic [ ] frequency").

Figures 33 and 34 of the '490 Patent and '737 Patent likewise show that the "intrinsic frequency" is determined based on the peak in the Fast Fourier Transformation using the "optimal fit" (a Gaussian fit).

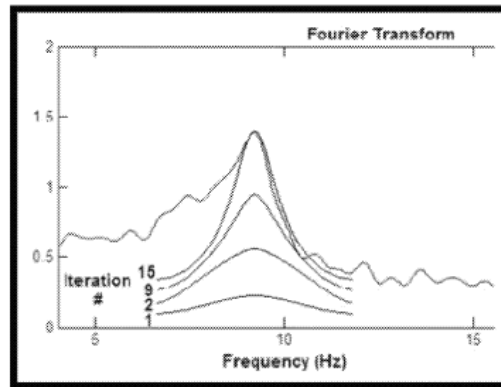


Figure 33

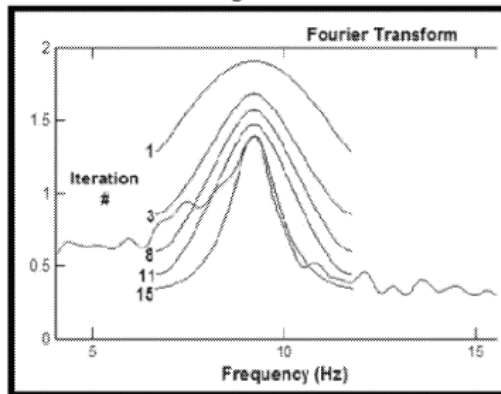


Figure 34

'490 Patent Figures 33, 34; '737 Patent Figures 33, 34. *See also* '490 Patent at 1:55–2:12 (discussing optimization for determining “intrinsic frequency”); '737 Patent 1:54–2:10 (same).

Wave’s argument that Brain’s construction improperly imports a limitation into the claim is incorrect. While courts, absent a clear indication to do so, “will not at any time import limitations from the specification into the claims,” *CollegeNet, Inc. v. ApplyYourself, Inc.*, 418 F.3d 1225, 1231 (Fed. Cir. 2005), a subject’s “intrinsic frequency” *is* a fixed point on the frequency distribution. There is no limitation being imported because “intrinsic frequency” is an objective measurement which will always be at the peak, as specified in the patents. The specification “expressly define[s],” or at a minimum defines “by implication,” *Phillips*, 415 F.3d at 1321, the

term as it is “used in th[e] invention,” ’408 Patent at 15:49.<sup>6</sup> While the embodiments in the patents reflect different methods of applying the *treatment* (which should not be imported to narrow the claims), none of the embodiments define “intrinsic frequency” as anything other than the “peak signal in the specified band.”<sup>7</sup>

Brain’s construction is consistent with the intrinsic evidence. But so is Wave’s construction, as the “intrinsic frequency” is also what is selected for treatment. Wave’s construction, however, does not explain what an “intrinsic frequency” is, other than stating that it is “selected” for treatment. While it would be nonsensical to select a frequency other than the “peak signal power with a specified band” (as this selection would no longer be an “intrinsic frequency” and would render the Fast Fourier Transformation and fitted curve meaningless), Wave’s construction sweeps too broadly and does not accurately convey the term’s meaning as it is used in the patents.

In sum, Brain’s construction *defines* “intrinsic frequency” in the abstract, while Wave’s construction explains how one’s “intrinsic frequency” *is used* in the patents, without defining the term or specifying its limits. Still, “claim construction must result in a phraseology that can be taught to a jury of lay people.” *Control Res., Inc. v. Delta Elecs., Inc.*, 133 F. Supp. 2d 121, 127 (D. Mass. 2001). Brain’s use of terms such as “ $f(0)$ ” and “ $E_{MAX}$ ” is unnecessary.

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<sup>6</sup> Wave’s argument that this construction mixes up claim elements (Q-Factor and “intrinsic frequency”), ECF No. 32 at 21, is misplaced because Q-Factor and “intrinsic frequency” are proportional to each other and can be represented as a function of one another. This correlation does not change depending on a particular embodiment.

<sup>7</sup> One embodiment in each patent uses a calculation of “mean peak frequency” to determine the “intrinsic frequency of alpha EEG.” ’408 Patent at 52:29–31 (Figure 6, defining “intrinsic frequency” as the “mean peak frequency”); ’490 Patent at 69:58–59 (same); ’737 Patent at 64:51–53 (same). But this still defines “intrinsic frequency” as the “peak” by calculating the mean of three peak measurements, which would still reflect the “peak” of the specified band.

Accordingly, the Court construes “intrinsic frequency” to mean a “frequency at which peak signal power is located to which treatment is to be applied.”<sup>8</sup> This construction is supported by the intrinsic evidence, avoids confusion, cures Brain’s objection that Wave’s construction would read out “intrinsic” from the claim such that “intrinsic frequency” could be any frequency which the selected for treatment, and is phrased such that the claim can be taught to a jury of lay people.

ii. “in-phase/in phase” and “out of phase”

The terms “in-phase” and “out of phase” are related and both appear in claims 1 and 12 of the ’408 Patent and claim 1 of the ’490 Patent. The dispute over these terms centers on whether the peaks and troughs of a wave form must appear at exactly the same time to be considered “in phase.” Wave asks the Court to construe the terms to mean “waveforms whose peaks and troughs occur at substantially the same time” (and “do not occur” for “out of phase”). ECF No. 31 at 9–10. Brain asks the Court to take a stricter approach, construing the term as “waveforms whose peaks and troughs occur at the same time.” *Id.* The Court agrees with Wave.

The terms are used in the context of applying the magnetic field to “move the EEG phase of the specified EEG frequency” by using two magnetic fields that are “in phase” or “out of phase” with each other. ’490 Patent at 85:35–38; ’408 Patent at 66:45–48, 67:55–58 (similar, also using magnetic generators). EEG Phase is one of the metrics, like “intrinsic frequency,” targeted for treatment. Magnetic fields, as used in the claims, are represented as waveforms with peaks and troughs. The parties agreed on a construction of EEG Phase as “a measure that conveys the difference, if any, between the timing of peaks and/or troughs in two EEG signals.” ECF No. 31

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<sup>8</sup> There is no need for “within a specified band” because nearly every use of the phrase in the patents is followed by “of the specified EEG band.” To the extent that phrase does not follow, the Court construes “intrinsic frequency” as “frequency at which peak signal power within a specified EEG band is located to which treatment is to be applied.”

at 5. The dispute between Wave and Brain centers on whether the “peaks and troughs” of the waveforms (of each magnetic field) must occur at exactly the same time.

Wave’s expert, Dr. Bikson, explained that a POSITA would understand that the timing need only be “substantially the same” because small differences in phase do not lead to large differences in results but can render a waveform out of phase. ECF No. 32-5 ¶ 96; ECF No. 41-1 ¶ 28 (explaining the numerical differences that a POSITA would understand would fall within “in phase” or “out of phase”). In other words, a waveform “whose peaks and troughs occur at substantially the same time” may still be in phase or out of phase with another.

Contesting this characterization without support from its own expert, Dr. Dempsey, Brain argues that the word “substantially” creates an overlap between the two terms, and instead insists on a precise demarcation in which one waveform is either in phase or out of phase with another. As Dr. Bikson explained, however, this is not how a POSITA would understand the terms to be used: “just because two waveforms are not in-phase does not necessarily mean they are out of phase.” *Id.* ¶ 31. Brain’s argument that the parties’ construction of EEG Phase as “a measure that conveys the difference, if any, between the timing of peaks and/or troughs in two EEG signals” requires that if there is no difference, the signals are in-phase (and if there is a difference, the signals are out-of-phase) is incorrect. As Dr. Bikson explained, a small difference between the peaks and troughs may still be in-phase (and vice-versa). And Brain’s reference to Dr. Bikson’s statement that “a small difference in phase between two waveforms leads to results in which the waveforms are not in-phase” omits his explanation that this small difference is why a POSITA would understand, under these circumstances, that the magnetic fields may still be “in phase.”

Dr. Bikson also explained that the term “substantially” accounts for the limitations of mathematics, where two brain waves are never identical but always contain some difference

dependent on the level of precision of measurement being used. *Id.* ¶ 33; *see also* '408 Patent at 55:42–49 (using “generally in-phase” in discussing the magnetic field). Brain did not rebut this.

iii. “Q-Factor”

The term “Q-Factor” appears in claim 1 of the '490 Patent, claims 1–2, 12, and 20 of the '408 Patent, and claims 1–2 and 4 of the '737 Patent. Wave asks the Court to construe the term to mean “the ratio of the intrinsic frequency relative to the frequency bandwidth at half peak energy.” ECF No. 31 at 10–11. Brain asks the Court to construe it at “the ratio of  $f_0 / \Delta f$ , where  $f_0$  is the intrinsic frequency and  $\Delta f$  is the frequency bandwidth for which the energy is above one-half the peak energy in the specified band.” *Id.* at 11. These are essentially identical, except for “in the specified band.”<sup>9</sup>

The Court agrees with Wave that the addition of “the specified band” is implied because the “intrinsic frequency” must itself be identified within a specified band, and so is unnecessary. Consistent with its construction of “intrinsic frequency,” the Court concludes that the inclusion of (f) and  $\Delta f$  are unnecessary. Thus, the Court adopts Wave’s construction.

iv. “coherence value”

The term “coherence value” appears in claim 1 of the '490 Patent and claims 1, 12, and 20 of the '408 Patent. Wave asks the Court to construe the term as “a measure of similarity between two or more signals over time,” whereas Brain insists that the term refers to “the difference between the frequency and phase of two waves.” ECF No. 31 at 12. The Court agrees with Wave.

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<sup>9</sup> There is no difference in the phrasing “at half peak energy” compared to “above one-half the peak energy,” as both refer to the bandwidth of the frequency curve, such that the difference in hertz at half peak energy of the curve are used to calculate the bandwidth. In other words, one refers to the precise two points on the frequency distribution, whereas the other refers to the range of frequencies within the two points on the distribution, wherein the bandwidth is the same.

Brain’s expert, Dr. Dempsey, does not explain how a POSITA would understand “coherence value,” instead arguing that it is too indefinite.<sup>10</sup> Wave argues that its construction is supported by the intrinsic evidence, including the specification and the prosecution history. None of the specifications define coherence value. But the prosecution history, which is of “primary significance in understanding the claims,” *Markman*, 52 F.3d at 980, does:

Coherence, as used in the present application, refers to how closely matched are the intrinsic frequencies among multiple sites in a brain of the subject within a specified EEG band (*e.g.*, how closely matched is a first intrinsic frequency of a first site in the brain of the subject within a specified EEG band to a second intrinsic frequency of a second site in the brain of the subject within the same EEG band, at least). (See, *e.g.* para [0169], at least). It is expressed as a coherence value. Thus, if the two or more intrinsic frequencies are matched in frequency, a coherence value shows this matching characteristic. Likewise, if the two or more intrinsic frequencies are not matched, the coherence value expresses this. A coherence value that is higher (more coherent) would indicate that the intrinsic frequencies are more closely matched than the situation in which a coherence value is lower (indicating less coherent).

ECF No. 38-2 ¶ 94 (quoting ’408 Patent Prosecution History at 737).

According to Wave’s representations when prosecuting the patent, the “coherence value” is a metric that expresses “how closely matched” the intrinsic frequencies are within a specified EEG band. Brain offers an alternate construction referring to a “difference between the frequency and phase of two waves” but cites no relevant support for this construction, either in the intrinsic evidence or extrinsic evidence. While “closely matched” may very well be the same as a measurement of “difference,” the Court adopts the term as used in the patent prosecution as it is the relevant intrinsic evidence. Brain points to the prosecution history’s use of “coherence” as referring to “waves with the same frequency and in phase,” but, as Dr. Bikson notes, the language in the prosecution history describes how coherence was used in prior art references. *Id.* ¶ 105.

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<sup>10</sup>The Court declines to make invalidity determinations at this stage. *See infra* pp. 2–3.



This use also contradicts Brain’s own construction, because coherence, according to Brain, is the “difference” between the frequency and phase of two waves—not a measure of similarity.

Further, Brain admits that “coherence” and “value” are common terms, and Dr. Bikson used these terms as support in coming to his construction as a POSITA. ECF No. 38-2 ¶ 81 (“coherence has a meaning that is well-known in mathematics” and “value” refers to the number that is the result of a calculation”). While Brain’s expert, Dr. Dempsey, argues that these terms are “generic,” ECF No. 34-1 ¶ 30, he did not dispute that the terms are commonly used in the fields.

v. “close to the head”

The term “close to the head” appears in claim 1 of the ’490 Patent, claims 1–2 of the ’408 Patent, and claims 1–2 of the ’737 patent. Wave asks the Court to construe the term to mean “wherein the head is not outside the magnetic field.” Brain seeks to construe the term as “near the head, but not on the head.” ECF No. 31 at 16. The Court agrees with Wave.

The term “close to the head,” as used in the patents, refers to the magnetic field to which treatment is applied. It does not refer to specific magnets placed on a subject’s head, unlike the EEG electrodes, which *are* placed on a subject’s head (or wrapped in a casing and placed on the subject’s head). *See* Wave Presentation at 107. Dr. Bikson explained that a POSITA would understand that “close to the head” is meant to ensure that the magnetic field is close enough for the TMS protocol to work, i.e., within the zone of the magnetic field. ECF No. 38-2 ¶¶ 228–42.

Brain’s expert, Dr. Dempsey, did not offer an alternative understanding. Still, Brain argues that, because claims are construed “as written, not as the patentees wish they had written it,” *Chef Am., Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1374 (Fed. Cir. 2004), the Court should not read “close to the head” to include a magnetic field “on” a subject’s head. Dr. Bikson, on the other hand, cites specifications wherein the magnetic field can be “0 inches” to the head, i.e., “on” the

head, consistent with Wave’s understanding that a magnetic field “on” the head necessarily means that the head is “not outside the magnetic field.” *See* ’490 Patent at 9:57–67; ’408 Patent at 6:13–23, ’737 Patent at 9:52–62. Further, nothing in the term excludes a magnetic field from being “on the head” where the magnetic field is also “close to the head.” While Brain points to the embodiments in the patents which show magnets as being “close to the head” and not “on the head,” it would be improper to import this limitation to the claims themselves.

### CONCLUSION

Accordingly, the Court construes the six contested claim terms as follows:

Term	Construction
“intrinsic frequency”	“frequency at which peak signal power is located to which treatment is to be applied”
“in-phase/in phase”	“waveforms whose peaks and troughs occur at substantially the same time”
“out of phase”	“waveforms whose peaks and troughs do not occur at substantially the same time”
“Q-Factor”	“ratio of the intrinsic frequency relative to the frequency bandwidth at half peak energy”
“coherence value”	“a measure of similarity between two or more signals over time”
“close to the head”	“wherein the head is not outside the magnetic field”

The Court further construes nine agreed-upon claim terms as follows:<sup>11</sup>

Term	Construction
“move a/an/the”	“shifts or alters a/an/the”
“moving”	“shifting or altering”

<sup>11</sup> The parties agreed on eleven claim terms, but two of these were for the ’111 Patent which is no longer at issue. *See supra* note 1; ECF No. 31 at 3, 5. Additionally, two of these claim terms (“move a/an/the” and “moving”) were agreed upon in the event Brain was unsuccessful in its invalidity challenge. *See* ECF No. 31 at 4. While the Court declined to address invalidity at this stage, *see supra* p. 2, Brain listed these terms as “agreed terms” at the *Markman* hearing. *See* Brain Presentation at 22.

“to a target”	“to be substantially the same as a target”
“toward a”	“closer to”
“magnetic field”	“a region around a magnetic material or a moving electric charge within which the force of magnetism acts”
“second magnetic field”	“a region around a second magnetic material or a second moving electric charge within which the force of magnetism acts”
“[within a/the] specified EEG band”	“the band within which an intrinsic frequency is chosen and treatment is performed selected from the group consisting of one of the alpha band, beta band, delta band, gamma band, or theta band”
“EEG phase”	“a measure that conveys the difference, if any, between the timing of peaks and/or troughs in two EEG signals”
“pre-selected [intrinsic frequency/Q-Factor/coherence value/direction]”	“a targeted [intrinsic frequency/Q-Factor-coherence value/direction] chosen before treatment”

It is so **ORDERED**.

**SIGNED** this 12th day of November, 2024.



XAVIER RODRIGUEZ  
UNITED STATES DISTRICT JUDGE